

REMARKS

Favorable reconsideration of this application in view of the above amendments and remarks to follow is respectfully requested.

Applicants acknowledge, with thanks, the Examiner's indication in the Office Action dated March 31, 2003 that Claims 21-22 are allowable over the art of record. Although allowance of Claims 21-22 is indicated, applicants, at the present time, would like to obtain a patent including all the claims pending in the present application.

Before addressing the specific rejection raised in the present Office Action, applicants have amended Claim 1 to clearly and positively recite, "forming a second polymeric material that is partially cured to a B-stage state atop said first polymeric material and said conductive bump material." Support for this amendment is found throughout the present specification; i.e., Page 8, line 26 – Page 9, line 4 and FIGS. 1E – 1G. More specifically, referring to FIG. 1F, applicants disclose that the second polymeric material 20 is deposited directly atop and in contact with the first polymeric material 14 and conductive bump material 18.

Claims 1-20 stand rejected under 35 U.S.C. §103(a) as allegedly obvious over U.S. Patent No. 6,228,678 to Gilleo, et al. ("Gilleo, et al.") in view of U.S. Patent Publication No. 2002/0105092 to Coyle ("Coyle"). Applicants' respectfully traverse the §103 rejections and submit the following.

Applicants submit that the claims of the present application are not rendered obvious by the disclosures of the applied references because the applied references fail to teach or suggest all of the limitations of applicants' claimed method. Specifically, the applied references fail to teach or suggest, "*forming a second polymeric material that is partially cured to a B-stage state atop said first polymeric material and said conductive bump material*", as recited in amended Claim 1. "To establish a prima facie case of obviousness of a claimed invention all the claimed

limitations must be taught or suggested by the prior art”. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Applicants submit that Claim 1 is not made obvious by the disclosure of Gilleo, et al., since the applied reference does not teach or suggest applicants’ claimed method. Specifically, the primary reference Gilleo, et al. does not teach or suggest “*forming a second polymeric material that is partially cured to a B-stage state atop said first polymeric material and said conductive bump material*”. Applicants observe, referring to Page 5 of the Final Rejection dated December 4, 2002, that the Examiner agreed that, “Gilleo fails to teach a partially cured second polymeric material over a first polymeric material and conductive bump material”.

Additionally, Gilleo, et al. fail to teach or suggest partially curing the second polymeric material to a B-stage state. Curing a polymeric material to a B-stage state requires advancing the reaction of a thermosetting polymer to below the gel point to which the material becomes insoluble. The gel point is the point at which cross-linking occurs. B-staging renders thermosetting materials non-tacky since it raises the glass transition temperature of the polymer to above room temperature. Tacky materials are soft at room temperature. In thermoplastics, this is not possible because thermoplastics do not react. Thermoplastics do not cross-link because all the reactions to the polymer backbone have concluded.

Gilleo, et al. do not teach or suggest partially curing the second polymeric layer to a B-stage state. Applicants observe that one embodiment of the Gilleo, et al. disclosure is a first polymeric layer which includes a thermoplastic resin as the main component and a B-stage thermoset as a lesser component. Although Gilleo, et al. disclose that B-stage thermosets may be present in the first polymeric layer there is no teaching or suggestion of a B-stage thermoset being utilized in the second polymeric layer. Referring to Column 8, line 43-65, the second polymeric layer disclosed in Gilleo, et al. comprises a flux system including epoxy resins.

Applicants note, referring to Page 5 of the present Office Action, the Examiner agrees that Gilleo, et al. fail to teach that the second polymeric material is partially cured to a B-stage state as recited in Claim 1.

Additionally, Gilleo, et al. disclose the use of thermoplastic polymers as the main component of the underfill. Specifically, Gilleo, et al. referring to Column 7, lines 29-31, disclose that their method eliminates the problems associated with thermoset underfills by incorporating thermoplastics. Therefore, the Gilleo, et al. disclosure teaches away from applicants' claimed invention because Gilleo, et al. favor thermoplastics that cannot be cured to a B-stage state.

Coyle do not alleviate the deficiency of Gilleo, et al. since Coyle does not teach or suggest applicants' claimed method. Specifically, Coyle do not teach or suggest forming a bilayer underfill, "comprising the steps of forming a first polymeric material on a surface of a semiconductor wafer having interconnect pads disposed thereon; patterning said first polymeric to provide openings that expose said interconnect pads; forming conductive bump material in said openings; *forming a second polymeric material that is partially cured to a B-stage state atop said first polymeric material and said conductive bump material*; dicing said semiconductor wafer into individual chips; and bonding at least one of said individual chips to an external substrate, wherein during such bonding said conductive bump material penetrates said second polymeric material and contacts a surface of said external substrate", as recited in amended Claim 1.

Coyle discloses a method for producing a robust molded chip scale package having a chip with bumped flip chip interconnection to a flexible film substrate including conventional underfill process steps. More specifically, referring to Paragraphs 0045 and FIG. 5a, Coyle discloses a conventional underfill method where a plurality of IC chips 50 having bump contacts

51 are aligned to receiving pads on patterned flexible film substrate 52, and the bumps are adhered to the substrate 52. Now referring to FIG. 5b, an underfill material 54 is dispensed under each chip 50, and the polymeric material 54 is partially cured. Referring to Paragraph 0046 and FIG 5c, a plastic encapsulate 58 is then applied over the entire structure.

Applicants submit that the method disclosed in Coyle is substantially removed from applicants' claimed method in which the first polymeric material (underfill) 14 and the second polymeric material 20 are applied prior to bonding the IC chip 24. In addition to teaching a substantially different method, applicants submit that Coyle fails to teach or suggest a second polymeric layer that is partially cured to a B-stage state atop a first polymeric material and conductive bump material. It is the Examiner's position that "Coyle discloses forming a second polymeric material 58 that is partially cured to a B-stage state over the first polymeric material 52 and the conductive bump material 51." Applicants disagree and note that reference number 58 denotes an encapsulating material, which is formed atop the IC chips 50 that are bonded to the bump contacts 51 atop the flexible film substrate 52. The encapsulating material 58, referred to by the Examiner as the second polymeric material, is not positioned atop the bump contacts 51 or beneath the IC chip 50. The encapsulating material 58 disclosed in Coyle provides electrical and mechanical protection for the IC chip 50 by enclosing the IC chip 50 in a rigid plastic. *See* Paragraph 0038. Therefore, because the IC chip 50 is positioned between and separates the encapsulating material 58 and the bump contacts 51, Coyle does not teach or suggest forming a second polymeric material that is partially cured to a B-stage state atop said first polymeric material and said conductive bump material, as recited in amended Claim 1.

The §103 rejection also fails because there is no motivation in the applied references which suggests modifying the methods disclosed therein to include the applicants' claimed method having the process step of forming a second polymeric material that is partially cured to

a B-stage state atop said first polymeric material and said conductive bump material, as recited in amended Claim 1. This rejection is thus improper since the prior art does not suggest this drastic modification. The law requires that a prior art reference provide some teaching, suggestion, or motivation to make the modification obvious.

Here, there is no motivation provided in the disclosures of the applied prior art references, or otherwise of record, which would lead one skilled in the art to modify the methods of the applied references to include applicants' claimed sequence of processing steps recited in amended Claim 1. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d, 1260,1266, 23 USPQ 1780,1783-84 (Fed. Cir. 1992).

Applicants submit that one of ordinary skill in the art would not be motivated to combine Gilleo, et al. with Coyle, because the applied references teach away from the Examiner's proposed combination. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. W.L. Gore and Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983).

Gilleo, et al. are concerned with reworking during chip mounting process steps and overcoming the disadvantages of thermoset underfills. Gilleo, et al. disclose, referring to Column 7 lines 29-35, that the problems associated with thermoset underfills can be overcome by incorporating a thermoplastic as a main constituent of the of the underfill. Coyle, referring to Paragraph 0010, discloses a conventional underfill process where an objective of the process is to produce a robust molded chip scale package. Coyle further discloses, referring to Paragraph 0036, that underfill materials provide mechanical stability to the device and that in producing a robust molded chip scale package thermosetting underfill materials are preferred. Therefore,

since Gilleo, et al. teach that thermosetting underfills should be avoided for the purposes of reworking and Coyle discloses that thermosetting underfills are preferred for increasing the mechanical strength of the chip, the applied references teach away from their combination. Therefore, one of ordinary skill in the art would not be motivated to combine the Coyle and Gilleo, et al. references to produce the applicants' claimed method.

Based on the above amendments and remarks, the §103 rejection has been obviated; therefore reconsideration and withdrawal of the instant rejections are respectfully requested.

In summary, applicants respectfully submit that this application is in condition for allowance. Accordingly, applicants respectfully request that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the applicants' representatives would be advantageous to the disposition of this case, the applicants request that the Examiner telephone the undersigned.

Respectfully submitted,



Leslie S. Szivos, Ph.D.
Registration No. 39,394

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, New York 11530
(516) 742-4343

HAH/LSS:lac/sf